FRD Activities Report
December 2000

Research Programs

Extreme Turbulence (ET) Probe

During hurricane landfall deployments, the ET probe will experience both high wind and frequently heavy rain. To explore the response to rain, a rain accelerator (Figure 1) was built to simulate the impact of high velocity rain drops on the surface of the ET Probe sphere. The pressure side of a shop vacuum was used in conjunction with a tapered probe to accelerate well formed rain drops in a laminar flow of air. This allows the rain drops to be consistent in size, velocity and impact position. In particular, we were interested in the affect of the droplets as they impacted the small pressure ports that are used to measure wind velocity and turbulence on the ET Probe. Initially back flow air was set at 1 cc/minute to keep water out of the pressure ports. However, at 1cc/minute, pressure pulses caused by rain impact were longer lasting and of similar amplitude as those pulses caused when flow was increased to 30 or even 120 cc/minute. Droplets seem to be driven farther into the pressure ports and pushed out slower at the lower flow rates causing the longer rain (noise) pulses. The expected increase in the pressure transducer output offset voltage will cancel on the differential pressure sensors. A graph showing the effect of a single rain drop impact with a back flow of 120 cc/minute is shown in Figure 2. Note that the impact of the rain on the sensor port creates a very sharp pressure spike. (Randy.Johnson@noaa.gov, Tim Crawford, Eric Egan, Jerry Crescenti).

Fig. 1. Picture of rain accelerator and half of the ET Probe sphere.

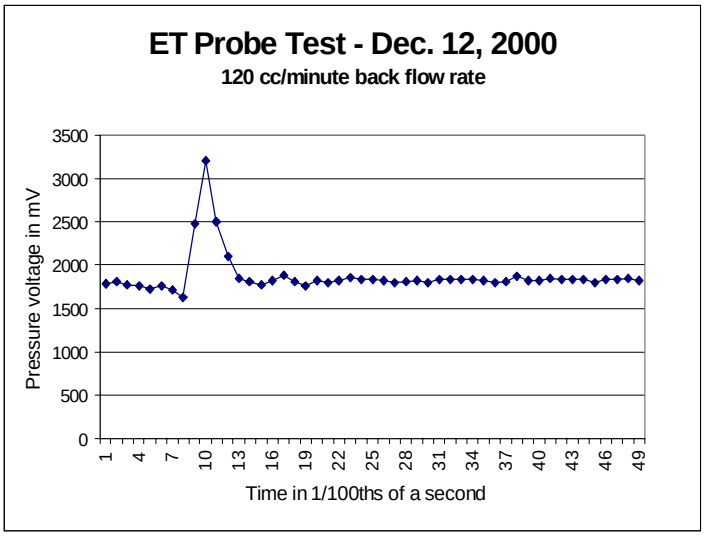

Fig. 2. Graph showing response to rain drop impact on ET Probe pressure port.

Central California Ozone Study (CCOS)

All of the data acquired during the Central California Ozone Study (CCOS) has been put through quality control screens. This includes data from nine meteorological towers and wind profiles acquired by a 915-MHz radar wind profiler and Doppler sodar. The final data sets was released to the California Air Resources Board (CARB) early this month. In addition, a data report was recently published and released (Jerry.Crescenti@noaa.gov, Neil Hukari)

Wave Profile Experiment (WAPEX)

Efforts are underway to enhance the LongEZ data collected during the Wave Profile Experiment (WAPEX) in November 1998. This includes using an improved differential GPS correction algorithm (*flykin*) which has reduced the noise (i.e., variance) in the wind velocity by about 20%. In addition, new calibration offsets are being determined to correct a bias in the mean wind speed and direction. (Jerry.Crescenti@noaa.gov, Jeff French)

VTMX-CBNP 2000

The extraction of SF_6 plume crossings from the TGA-4000 continuous analyzer data collected in the VTMX study has been completed. The plume crossings noted by the TGA operators are identified and extracted from the continuous data stream. These are then converted from voltage to SF_6 concentration and each stored in a separate ASCII file so it is easily available for further analysis. During the study, six TGA-4000s were operated during six tracer experiments and two TGA-4000s were operated during an initial shakedown experiment. This resulted in over 800 identified plume crossings that had to be reviewed and extracted. (Roger.Carter@noaa.gov)

Over 700 cartridges from the whole air samplers have been analyzed for the VTMX study. Data analysis became a longer than expected process due to the extremely wide range of concentrations from one sample bag to the next. All data is now in the QA/QC process. Every analytical run is being reviewed and verified. Some modifications have been made to the raw data software to make it more efficient and "user-friendly," as well as fix some information downloading glitches. (Debbie.Lacroix@noaa.gov)

AFTAC 2001

Funding has been received from the Air Force Technical Applications Center at Patrick AFB, Florida, for another tracer experiment involving SF_6. This is a continuation of the program begun at FRD a couple of years ago of a detection system under development by AFTAC. The tests will be conducted at Dugway Proving Ground, Utah, in either March or April. FRD will be responsible for releasing the tracer and its detection using our mobile real-time SF_6 analyzers. A planning meeting is scheduled at Dugway next month to hammer out details of the experiment. (Kirk.Clawson@noaa.gov)

Cooperative Research with INEEL

INEEL Mesoscale Meteorological Network

For about 18 months, we have been retrieving meteorological data from the RAWS stations operated by the US Forest Service and Bureau of Land Management. These data are used to compliment the data from the INEEL Mesoscale Meteorological Network. The data is provided to us by Boise National Weather Service office. Due to computer system changes at Boise, the automated data collection software had to be modified. The changes were implemented Dec. 4 and have been operating successfully since then. (Roger.Carter@noaa.gov)

INEEL Mesoscale Modeling

During the past two months, there have been numerous problems with downloading the Eta model GRIB files that are used to initialize the MM5 mesoscale model at FRD. On many days, the Eta files have either been missing or are corrupted in a way that causes the ftp download to fail. Modifications have been made to the Perl script file that downloads the files to get around some of these problems. The script now attempts to download the files from an alternate ftp server if problems are encountered with the primary NWS server. Also, the script interpolates over missing files if Eta output from surrounding times is available. (Richard.Eckman@noaa.gov)

Scripting software has been written that allows graphical output from the MM5 simulations to be viewed in a Web browser using HTML. A Java applet is used to display animated model output for the region surrounding INEEL. The applet allows the user to control the speed of the animations or to step manually through the images. Currently, access to the Web animations is limited to FRD staff as further testing continues. (Richard.Eckman@noaa.gov)

Underground Transport Feasibility Test

At the request of the INEEL, one of our TGA-4000 continuous SF_6 analyzers was used to sample air from a test well and soil probes located on the INEEL. The intent of the experiment was to test the feasibility of using instrumentation similar to the TGA-4000 to monitor the movement of materials trapped underground. The TGA-4000 did respond to samples drawn from the test well to depths of 250 feet. However, the results could not be quantified because the samples likely contained several different compounds that the TGA-4000 responds to. (Roger.Carter@noaa.gov, Debbie.Lacroix@noaa.gov)

Other Activities

ARL Booth

Efforts continue on the development of an ARL booth which will be in the exhibit hall during

the 81st Annual Meeting of the American Meteorological Society (AMS) to be held from January 14-19, 2001, in Albuquerque, New Mexico. ARL technology will be the central theme to the booth. Exhibit props will include the Extreme Turbulence (ET) probe being jointly developed by FRD and ATDD, the LongEZ with an emphasis on the small environmental research aircraft (SERA) concept, and demonstrations of the READY model by HQ staff and Models-3 by ASMD. Barbara Shifflett (ATDD) and Jerry Crescenti have been spear-heading an intensive effort. (Jerry.Crescenti@noaa.gov, Tim Crawford).

Proposals

Work continued during December on an updated VERTEX (VERtical Tracer Exchange) proposal. The original proposal discussed the use of perfluorocarbon tracers to study venting of pollutants by active cumuli at the top of the convective boundary layer. After some internal discussion, it was decided that ambient water may be a viable alternative tracer for studying such venting. The total experiment costs would be significantly reduced since there would be no need for an airborne tracer release mechanism. The viability of using water vapor as a vertical-exchange tracer has already been demonstrated by some previous field studies, including Crum and Stull (1987, *J. Atmos. Sci.*, **44**, 2743-2753) and Young, et al. (2000, *J. Atmos. Sci.*, **57**, 3145-3160). For VERTEX, the proposed tracer would be total water mixing ratio (*i.e.*, both vapor and liquid). The measurements would be collected using the LongEZ aircraft based at FRD. Currently, the LongEZ has no sensor for measuring liquid water, but a King probe is commercially available for about $10,000. (Richard.Eckman@noaa.gov, Tim Crawford, Jeff French)

Papers

Crescenti, G. H., N. F. Hukari, R. C. Johnson, T. W. Strong, and S. A. Beard, 2000: Data report: surface and upper-air meteorological data acquired during the Central California Ozone Study (CCOS). NOAA Data Report, OAR ARL-21, Silver Spring, MD, 102 pp.